

An Investigation of the Effectiveness of Choreography for the Portrayal of Mood in Virtual Environments.

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ABSTRACT

Choreography uses patterns of movement to portray moods and emotions. It therefore provides the designers of virtual environments with an opportunity to overcome some significant limitations of current virtual worlds, which are perceived as places lacking atmosphere and feeling. The paper reports the results of an experiment, which established that choreographic techniques can be used for the portrayal of specific moods by groups of automated agents in 3D virtual worlds.

Keywords

Choreography, mood, gesture, design, agents

1. INTRODUCTION

Feelings and emotions are naturally expressed through movement. Choreographers use these natural patterns of movement, gestures, as the elemental building blocks for dance because, although "There is no one way of showing meaning in movement... there are accepted patterns...[which] originate from the natural symptomatic movement language of humans" [5]

Choreographic theory identifies four key elements in dance: design, dynamics, rhythm and form [1,2]. Design refers to the shape of movements and incorporates contrasts such as *symmetry Vs asymmetry* and *opposition Vs succession*. *Level, size, contrast, direction* of movement and *space relations* [3] between figures are further aspects of design. Dynamics describes the quality (e.g. *staccato Vs legato*) and tempo of movement. Rhythm refers to the regularity of movement and form to the overall structure and organisation of the dance. Group movement and dance can be analysed and created in terms of these basic elements. Choreography therefore offers designers of virtual worlds, peopled with anthropomorphic agents capable of movement in groups, the potential for imbuing their worlds with feeling and emotion. The question arises to what extent specific moods can be generated in a group of such agents using choreographed

movements based on these fundamental elements. The experiment reported here addressed this issue using a 3D space implemented in VRML and accessed via a standard Internet browser.

2. THE EXPERIMENT

The experiment was designed to test two hypotheses:

1. Choreographic techniques can portray moods which are clearly distinguished and identifiable by viewers;
2. A change of viewing angle by 90° will alter the perception of the mood portrayed.

Four mood conditions were defined based on a binary quantization of each of the two orthogonal factors of *pleasure* and *arousal* that have been claimed to underlie the full circumplex of mood states [4]. The four moods were named *danger*, *happy*, *sad* and *peace*.

Four two-minute dance sequences were created. Each sequence was designed using the choreographic techniques outlined above to represent one of the mood states. Five movements were selected for each dance in which eight anthropomorphic agents were used to portray the group dynamic appropriate to each prescribed mood. The animations were created in Life Forms 3.0 Human Figure animation software and applied to wireframe figures which were then exported to VRML, where they were fully optimised to the lowest polygon count. The same agent design was used for each of the figures; the agents were 3D humanoid figures, with no striking gender specification.

A neutral virtual stage environment was created for the agents. Two fixed viewpoints were used to assess the influence of direction on the mood perception. Each animation was viewed once from the front and once from the side. The virtual environment was designed to look identical from both viewing angles.

Each agent was textured with a single colour to allow its movements to stand out against the background. Three primary colours, three secondary colours and two additional colours were used to ensure that no single colour was dominant. No sound was used in the experiment so that the movement of the agents was the main factor portraying the mood.

The experiment used a repeated measure, balanced order design in which 64 participants (balanced for age group and gender) experienced 8 conditions given by the four dances (mood conditions) each viewed from two angles (front and 90°).

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Figure 1: Examples of Happy, Danger, Sad, Peace (clockwise from top-left)

Following the viewing of each dance, participants completed a semantic differential questionnaire designed to measure the perceived strength of response to 18 emotion attributes relevant to the definition of the four moods.

3. RESULTS

A discriminant analysis was carried out on the results of the semantic differential questionnaire for the four dances viewed from 0° and a second for the dances viewed from 90°. This procedure finds the best combination of functions which discriminates between the four experimental conditions.

A two function discriminant analysis explained 97.6% of the variance between the four experiment conditions for the front view and 98.1% for the side view. It was therefore concluded that a 2D model for discrimination between the four mood conditions was a good fit. Furthermore the results from the semantic differential questionnaire, which produced similar profiles for both viewpoints, suggests that the perception of the four moods are similar regardless of viewing angle.

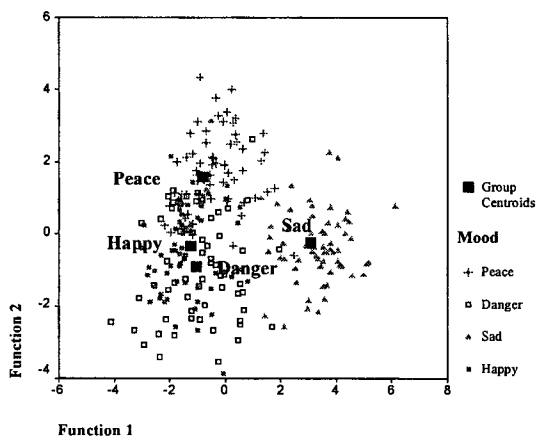


Figure 2: Scatterplot showing grouped mood conditions for the front view

Figures 2 and 3 show that the four mood conditions are well distinguished from each other, with *sad* being particularly well distinguished. There was some overlap in both viewpoints between *happy* and *danger*, indicating some difficulty in distinguishing between these moods.

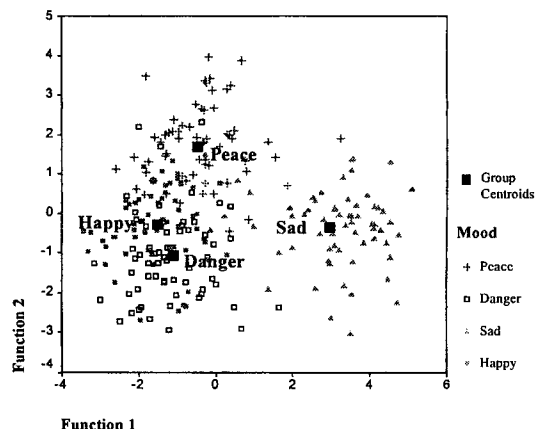


Figure 3: Scatterplot showing grouped mood conditions for side view

4. CONCLUSIONS

It is concluded on the basis of this experiment that it is possible to portray moods using choreographic techniques applied to groups of agents in virtual environments, although there was some confusion between the high activation conditions. It is also clear that (contrary to expectation) the perception of the choreographed mood portrayals was not significantly altered by a 90° change of viewing angle, indicating that the choreographic cues other than those dependant on viewing angle were strong enough to portray the mood.

The difficulty in discriminating the two high activation mood conditions (*happy* and *danger*) may be attributable to the fact that both these portrayals had a fast tempo and extensive movement making individual salient features difficult to interpret. The low activation portrayals (*peace* and *sad*) may have been more easily identifiable because the slower tempo and evenly spaced agents enabled the viewer to clearly see movements and categorise them as either pleasant or unpleasant.

5. ACKNOWLEDGEMENTS

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